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# N<sub>2</sub> PSA Gas Generator

CE Certification acquired  
Nitrogen Generator  
[Reg. No. K3093/M10]



(주)원하이테크  
WON Hi Tech Corp.

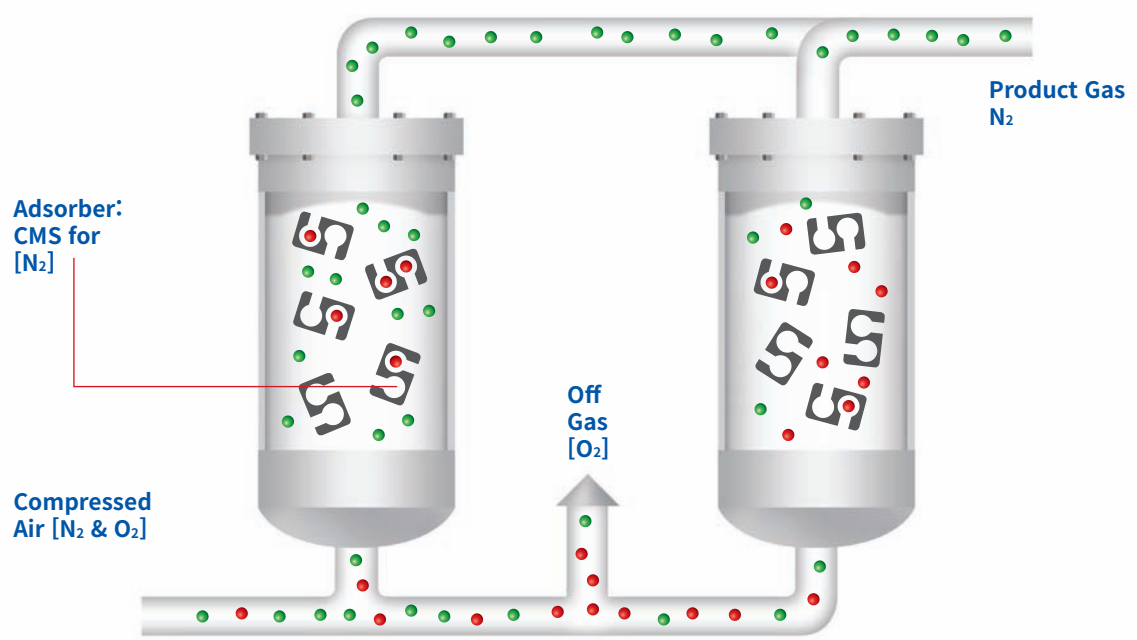
# N<sub>2</sub> PSA Gas Generator



## Pressure Swing Adsorption [PSA] Technology


Pressure Swing Adsorption (PSA) is a technology that can separate the desired gas compounds by using the difference of adsorption force of the individual crystals of gas from Molecular Sieve. In other words, adsorption may be defined as binding the gas molecules to the Adsorbent that is a solid substance through the suction force of the molecule.

A PSA system can separate the gas compounds by using the difference of adsorption force presented by the various chemical compounds or each individually. In the gas separation process, the compressed air passes through the Molecular Sieve layer composed of crystals with micro pores and the gases to be adsorbed becomes adsorbed by the adsorbent while the gas to be separated passed through the layer freely. The PSA Nitrogen Generator with the adsorbent called CMS (Carbon Molecular Sieve) phases in the compressed air filled with two or more adsorption towers that are moisture controlled, progresses the following steps that are repeated: compression → adsorption → decompression → purge to continuously produce the high purity Nitrogen.

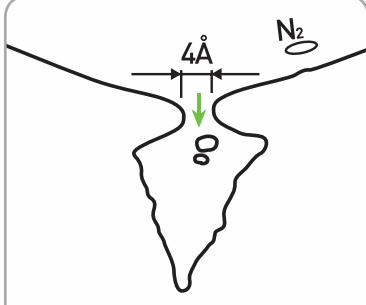


## Carbon Molecular Sieve [Adsorption Principle]

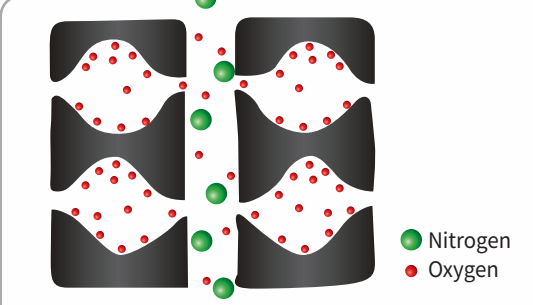
CMS is a 4Å crystal structure with a great number of micro pores made from the bark of a palm tree. Derived from the difference in diameter as the outer diameter of the Oxygen is 3.8Å while the outer diameter of the Nitrogen is 4.2Å, the adsorption of Oxygen which takes a shorter amount of time is understandably used. Moreover, the product that can maintain a certain compressive strength and a uniform pore structure must be selected in order to produce high purity Nitrogen.



Carbon Molecular Sieve



CMS : 4Å



Adsorption Principle



## The Advantages of the WON Hi Tech Corp.[WHTC] Generating Device

- Implementation of a compact product with a simple structure derived from the best optimized design
- Implementation of the autonomous/ unmanned operation controlled electronically
- Affordable pricing due to the On-Site (site production) method of direct production using compressed air - Not to be effected by the price fluctuations or the delivery delays as liquid Nitrogen
- Designed to adequately reflect customization according to the user required specifications depending on the conditions of the Nitrogen purity, production pressure and etc. (Up to 95-99.9999%, 1-600Nm<sup>3</sup>/hr)
- CMS which is an adsorbent used in gas separation is semipermanently usable
- Not to be subjected to the High Pressure Gas Control Act as the operation is handled at low pressure compared to highpressure gas and no legal obligation needed concerning the gas storage vessel managed by the designated senior safety personnel(s)



TYPE	Liquid Nitrogen (LN <sub>2</sub> )	Nitrogen Generator (PSA)	MEMBRANE
Principles	<ul style="list-style-type: none"> <li>▪ Low temperature(-200°C) Cooling, boiling, separated by the difference</li> </ul>	<ul style="list-style-type: none"> <li>▪ CMS (Carbon Molecular Sieve) Using the selective gas adsorption properties</li> </ul>	<ul style="list-style-type: none"> <li>▪ Selective gas permeation when passing through Membrane</li> </ul>
Benefits	<ul style="list-style-type: none"> <li>▪ High purity gas 99.9999% N<sub>2</sub> Gas useable</li> <li>▪ Almost never mechanical breakdown factor occurrences</li> </ul>	<ul style="list-style-type: none"> <li>▪ Suitable for small &amp; medium scales</li> <li>▪ Unmanned Operation System</li> <li>▪ Not to be subjected to High Pressure Gas Laws</li> <li>▪ A stable supply</li> </ul>	<ul style="list-style-type: none"> <li>▪ Suitable for small scales (1~10Nm<sup>3</sup>/hr)</li> <li>▪ Compressed air used (Control unnecessary)</li> <li>▪ The device is simple &amp; the price is low</li> </ul>
Weakness	<ul style="list-style-type: none"> <li>▪ Purchase cost sustainable expenditures</li> <li>▪ Senior safety manager duties</li> <li>▪ The unit price rising cost factors occurring yearly</li> <li>▪ When not used the natural evaporation (0.5%/day)</li> </ul>	<ul style="list-style-type: none"> <li>▪ The initial investment is required</li> <li>▪ Low gas storage capacity</li> <li>▪ Regular term maintenance support</li> <li>▪ Supply halted when breakdown occurs</li> </ul>	<ul style="list-style-type: none"> <li>▪ The purity is low (Max 99.9%)</li> <li>▪ Restricted generated production</li> <li>▪ Gas supply halted in case of power failure</li> </ul>
N <sub>2</sub> Gas Purity	<ul style="list-style-type: none"> <li>▪ 99.99~99.99999%</li> </ul>	<ul style="list-style-type: none"> <li>▪ 95~99.9999%</li> </ul>	<ul style="list-style-type: none"> <li>▪ 95~99.9%</li> </ul>
COST	<ul style="list-style-type: none"> <li>▪ Expensive</li> <li>▪ The initial investment is low but with elapsed time the cost goes up</li> <li>▪ The rising cost of the unit price by yearly</li> </ul>	<ul style="list-style-type: none"> <li>▪ Investment recovered in 1 year &amp; 4 month in contrast to the Liquid Nitrogen</li> <li>▪ 1~2,000Nm<sup>3</sup>/hr Production possible</li> <li>▪ The initial investment is required</li> <li>▪ Back-up System can be installed</li> </ul>	<ul style="list-style-type: none"> <li>▪ Low cost / Affordable at low concentrations</li> <li>▪ The initial investment is required</li> </ul>
Ability to Respond to Process	<ul style="list-style-type: none"> <li>▪ Difficulty to respond to the process changes</li> </ul>	<ul style="list-style-type: none"> <li>▪ Possible to respond to the process changes (Purity adjustments)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Difficulty to respond to the process changes</li> </ul>
The Usage Purpose	<ul style="list-style-type: none"> <li>▪ Simple &amp; commonly generalized</li> </ul>	<ul style="list-style-type: none"> <li>▪ The most commonly used</li> </ul>	<ul style="list-style-type: none"> <li>▪ The adequate capacity</li> </ul>

# N<sub>2</sub> PSA Gas Generator



## Nitrogen Usage Classified by Purity

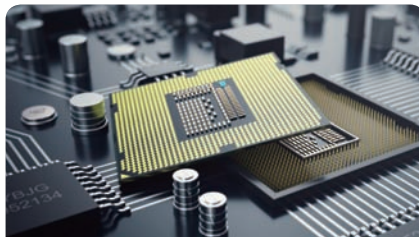
The Usage Purpose	N <sub>2</sub> Purity				
	Less than 99%	99%	99.9%	99.99%	99.999%
Reflow M/ C, Wave soldering M/ C Antioxidant of the Metal Product Manufacturing Sealing		●	●	●	●
The Gas Charge of Food Packaging	●	●	●		
Antioxidant of Manufacturing Medicine & Medical Supplies	●	●			
Storage of Fresh Fruits & Vegetables	●	●	●		
Bottle Manufacturing for Food Storage Gas Cooling		●	●	●	
Compression Molding, Gas Cooling	●	●			

## Nitrogen Generator Applied Field



### Chemical Related Industry

- Medicine & Medical Supplies/Raw Materials to be Transferred or for Storage
- Used for Chemical Reaction, Oxygen Barrier, Waste, Explosion



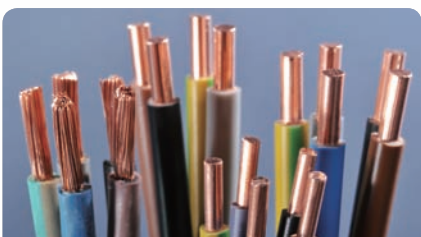
### Semiconductor Related Industry

- Used for Antioxidant and Product Storage and etc.



### Metal Heat Treatment

- Used for Antioxidant of Metal Heat Treatment



### Electric Wire Manufacturing

- Used for Antioxidant of Wire Heat Treatment, Copper Wire Annealing and etc
- Used for Power Line Manufacturing



### Solder Machine

- Used for Antioxidant N<sub>2</sub> Reflow



### Aluminum Casting

- Used for Dissolving & Casting of Aluminum



### Vessel

- Used for Nitrogen Supply & Explosion Prevention



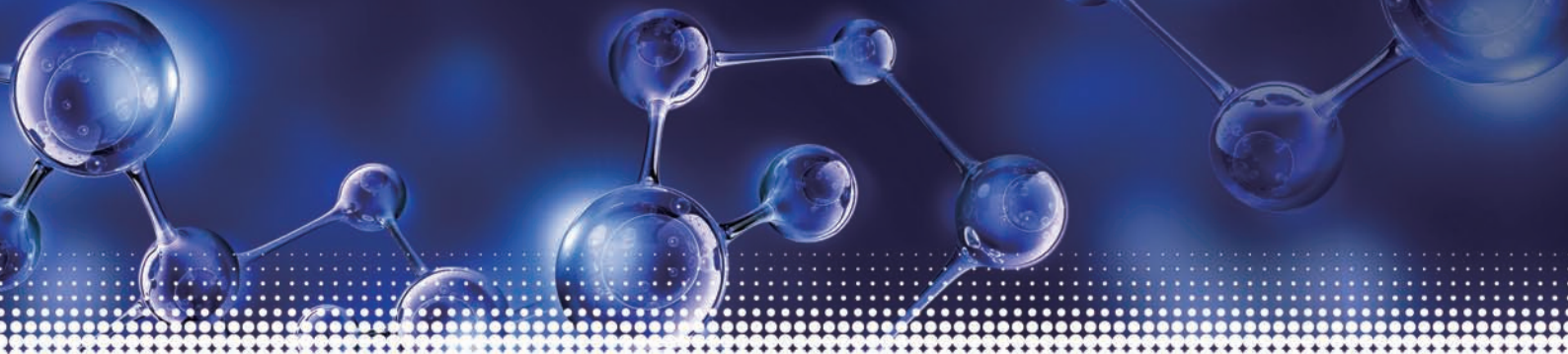
### Aircraft and Tire of Automobile Injection

- Used for the Injection to the tires of Aircraft & Automobiles



### Food Manufacturing and Applications

- Food Storage & Raw Material Raw Materials to be Transferred or for Storage and etc. And Nitrogen Gas



## Performance Table For P.S.A. Nitrogen Gas Generator

Model	NITROGEN CAPACITY (NM <sup>3</sup> /Hr)						100ppm	10ppm
	5%	3%	2%	1%	99.5%	99.9%	99.99%	99.999%
WHN-1B	5.9	4.6	4.1	3.3	2.8	1.8	1	0.5
WHN-2B	11.8	9.2	8.3	6.6	5.6	3.6	2	0.9
WHN-3B	17.6	13.6	12.3	9.7	8.2	5.4	3	1.4
WHN-4B	23.7	18.4	16.6	13.1	11.1	7.3	4	1.8
WHN-5B	29.3	22.7	20.5	16.2	13.7	9.0	5	2.3
WHN-6B	35.5	27.6	24.8	19.7	16.7	10.9	6	2.7
WHN-7B	42	32	29	23	20	13	7	3.2
WHN-8B	47	37	33	26	22	15	8	3.6
WHN-9B	53	41	37	29	25	16	9	4.1
WHN-10B	59	46	41	33	28	18	10	4.5
WHN-12B	71	55	50	39	33	22	12	5.5
WHN-15B	89	69	62	49	42	27	15	6.8
WHN-20B	118	92	83	65	55	36	20	9.1
WHN-22B	130	101	91	72	61	40	22	10.0
WHN-25B	148	115	103	82	69	45	25	11.4
WHN-30B	177	138	124	98	83	55	30	13.6
WHN-40S	237	184	166	131	111	73	40	18.2
WHN-50B	295	230	207	164	139	91	50	22.7
WHN-60S	355	275	248	196	166	109	60	27.3
WHN-70S	414	321	290	229	194	127	70	31.8
WHN-80S	473	367	331	262	222	145	80	36.4
WHN-90S	532	413	372	295	250	164	90	40.9
WHN-100S	591	459	414	327	277	182	100	45.5
WHN-150S	886	689	620	491	416	273	150	68.2
WHN-200S	1182	918	827	655	555	364	200	90.9
WHN-250S	1477	1148	1034	818	693	455	250	113.6
WHN-300S	1773	1377	1241	982	832	545	300	136.4
WHN-400S	2364	1836	1654	1309	1109	727	400	181.8
WHN-500S	2955	2295	2068	1636	1386	909	500	227.3
WHN-600S	3545	2754	2482	1964	1664	1091	600	272.7

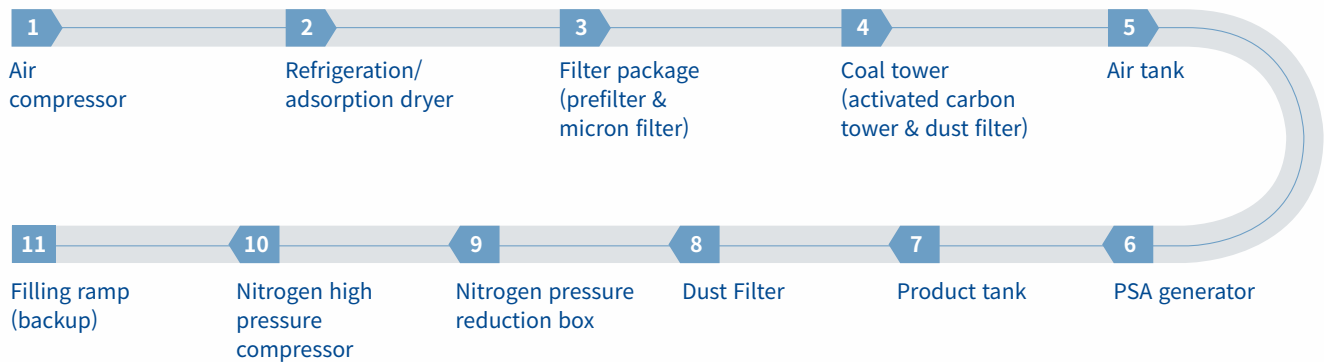
O2  
N2

### Calculation of the compressed air requirements

N <sub>2</sub> Purity	95%	97%	98%	99%	99.5%	99.9%	99.99%	99.999%
Air Factor	1.80	2.10	2.20	2.45	2.70	3.60	5.00	9.00

# N<sub>2</sub> PSA Gas Generator

## N<sub>2</sub> PSA Gas Generator Structure System





## Membrane Type Nitrogen Generator

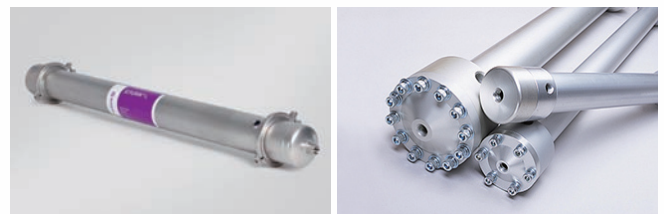
Membrane used for gas separation uses the principle of the selected gas permeation related to Membrane. Membrane Type Nitrogen Generator will use materials such as Polyimide and Polysulfone as the relative solubility of each gas composition and permeability for different substances will appear differently.

The Membrane Type Nitrogen Generator of WON Hi Tech uses a hollow fiber gas separation Membrane which transmits more Oxygen than Nitrogen for an easier penetration. In other words, when the compressed air is passed through the Polyimide hollow fiber Membrane, the Nitrogen which passes relatively more slowly is passed through the high pressure side (inside the hollow fiber) while the Oxygen is passed through the low pressure side (outside hollow fiber) and hence discharged to the atmosphere.



## Product Features of Membrane Type Nitrogen Generator

- Nitrogen can be obtained easily only with the dried compressed air.
- There is no noise occurrence as the transition of the adsorption/ regeneration cycle is not necessary.
- Only the minimum space is used due to the small volume.
- It is permissible whether it is horizontally or vertically placed, either way.
- The active power of Nitrogen generator is unnecessary.



Model	N <sub>2</sub> Gas Purity (%) and Volume (Nm <sup>3</sup> /H)					
	99.9%	99%	98%	97%	96%	95%
NM-B01A	0.025	0.071	0.1	0.14	0.17	0.17
NM-B02A	0.06	0.15	0.21	0.27	0.33	0.4
NM-B05A	0.12	0.34	0.49	0.63	0.77	0.92
NM-B10A	0.24	0.66	0.95	1.2	1.5	1.8
NM-C05A	0.26	0.74	1.1	1.4	1.7	2.1
NM-C07F	0.57	1.6	2.4	3.1	3.8	4.5
NM-C10A	0.57	1.6	2.4	3.1	3.8	4.5
NM-C10F	0.87	2.4	3.7	4.7	5.8	6.9
NM-C15A	0.87	2.4	3.7	4.7	5.8	6.9
NM-410A	1.2	3.6	5.2	6.8	8.3	10
NM-510F	3.7	12	17	22	27	32
NM-615A	3.7	12	17	22	27	32
NM-710F	4.8	21	31	41	51	62
NM-815	4.8	21	31	41	51	62
NM-1015	5.2	22	34	45	55	67



# WON Hi Tech Corp.

Since its foundation in 1993, WON Hi Tech Corp. has officially acquired the patent (Patent No.10-0861550, No.10-1773437) for gas separation technology using PSA (Pressure Swing Adsorption), based on the relentless R&D striving efforts and the vast extensive field experiences accumulated in the relevant field. Hence WHTC has become an expert specializing in the industrial Oxygen generators and the Nitrogen generators with its own innovative technology development providing to the domestic market as well as to the worldwide.

The electrical stability of the equipment is guaranteed by the acquisition of the CE certification and the durability of the equipment has been advanced by using the parts which conform to the international standards. In comparison to the domestic and the international market, the products of WHTC are economically feasible as the gas productions to input air volume is especially high.

WON Hi Tech Corp. manufactures and supplies Ozone Gas Generators, Ozone Dissolving, Systems, Ozone Analyzers, and Gas & Water Monitors. All the staff and administration of WON Hi Tech Corp. will never cease striving to become the world's leading manufacturers of the gas generators under our faithful committed motto of Ingenious Creativity, Challenging Spirit, and Team Work .



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